Section 6 -- Conclusions and Recommendations

Conclusions

Valued Ecosystem Component Approach

The Caloosahatchee MFL is intended to provide a salinity environment that will protect the submerged aquatic plant, *Vallisneria americana*, in the upper Caloosahatchee Estuary from significant harm. One of the major assumptions of this approach is that salinity and flow conditions that maintain *V. americana* will not be detrimental to other organisms in the estuary. Previous work on this subject (Chamberlain and Doering 1998) and results presented in this review support the validity of this assumption. Low MFL flows of about 300 cfs were not harmful to zooplankton and ichthyoplankton (fish larvae) or to oysters (*Crassostrea virginica*) living in the downstream, higher salinity, portions of the estuary. However, low flows can be associated with phytoplankton blooms in the upper estuary and these may result in water quality problems such as depressed oxygen and decreased light penetration. While evidence indicates that low flows in the 300 cfs range are not harmful to most estuarine species, rather high flows greater than 2500–3000 cfs appear to be detrimental to zooplankton, oysters and seagrasses. This high flow limit agrees with previous estimates (Chamberlain and Doering 1998; Doering et al. 2002).

Salinity Criteria

The Caloosahatchee MFL Rule contains two salinity criteria at the Ft. Myers salinity monitoring site: a 30-day moving average salinity of 10 ppt and a daily average salinity of 20 ppt. The summary of published information and the results of investigations by District staff presented here agree that these are scientifically-defensible physiological and ecological thresholds. The combination of results from field monitoring and laboratory experiments conducted by District and other investigators agree that 10 ppt is a critical threshold salinity that limits growth and salinities above 15 ppt cause mortality of *V. americana* The 30-day averaging period in the MFL rule is consistent with laboratory experiments which show that *V. americana* can survive exposure to salinities of 10 ppt for periods exceeding a month. The daily average salinity limit of 20 ppt was included in the rule to avoid acute exposure to high salinity. Laboratory experiments conducted by District staff indicate that a one day exposure to 20 ppt is a reasonable limit

for acute exposure. Analysis of 11 years of salinity data demonstrates that, in practice, the acute criterion is never violated before the 30-day moving average criterion.

Salinity and Freshwater Inflow

A thorough understanding of the relationship between freshwater inflow and the spatial distribution of salinity in the estuary is key to establishing an MFL. Over the past year, two new modeling tools have been developed to the point where they can be used to investigate this relationship. The Caloosahatchee Tidal Basin Model (Petersen et al. in review) allows estimation of freshwater inflows downstream of S-79. The SFWMD's Caloosahatchee Hydrodynamic model is a numerical, mass balanced, 3-dimensional model that estimates the distribution of salinity in the estuary under different freshwater inflow conditions. While both tools are still under development, they allow salinity in the estuary to be related to total inflow (i.e. discharge at S-79 + downstream tidal basin inflows).

The greatest uncertainty in the analysis presented here lies in the relationship between freshwater inflow and the distribution of salinity in the estuary. A mass balanced hydrodynamic model is the tool of choice because all inflows need to be quantified and specified. In terms of development, the mass balance hydrodynamic model employed here is in its infancy an has only been calibrated to a limited set of hydrologic conditions. The model uses woefully inadequate bathymetry, but new bathymetry data for the Caloosahatchee Estuary will be available soon. The model was not calibrated with tidal basin inflows, which are also uncertain. Major conclusions based on these preliminary salinity and flow modeling efforts are the following:

The MFL is not currently being met and a recovery and prevention strategy is required. This conclusion is consistent with the initial technical documentation. Construction of reservoirs and other projects in the C-43 basin being completed under the Comprehensive Everglades Restoration Plan (CERP) are major components of the recovery strategy.

Downstream tidal basin inflows are an important supplement to flows at S-79. Under current conditions, for 300 cfs released at S-79 to produce 10 ppt at Ft. Myers additional inflow from downstream tidal basin is required. This additional inflow may be on the order of 200 cfs (total = 500 cfs) but this is uncertain. Whatever the downstream

contribution needs to be, both the original regression analysis and the modeling approach presented here suggest that under current conditions a 300 cfs discharge at S-79 will on average produce a salinity of 10 ppt at Ft. Myers.

However, the importance of downstream, tidal basin inflows has several important ramifications. Under present conditions, releases of 300 cfs at S-79 are less likely to achieve 10 ppt under dry conditions when downstream inflows are low. As CERP components are constructed, overall salinity conditions will improve in the estuary. However, reservoir releases of 300 cfs are anticipated to occur during drier times when additional contributions from downstream sources may be very low, so that the 300 cfs flow from S-79 may be less likely to achieve the 10 ppt criterion.

Resource Based Evaluation of the Recovery Strategy

Modeling of *V. americana* shoot density data for two monitoring sites in the area designated for protection of *V. americana* indicates that the MFL is not presently being met and an inadequate level of resource protection exists. On the other hand, the results for *V. americana* shoot densities indicate that the CERP components may afford some level of resource protection at these two sites. Since Site two is located at 26 km upstream of Shell Point, the results suggest that CERP may provide resource protection over about two-thirds of the total area (the 6 km long zone that extends from 24 km to 30 km) that is set aside for protection of *V. americana*. Simulations indicate that exceedances of the 30-day average MFL salinity criterion occur at both Site 1 and Site 2 even with CERP components in place. These exceedances are of lower magnitude and shorter duration than those that currently occur. These results further indicate that 10 ppt is an effective criterion for protecting the *V. americana* community from significant harm.

Recommendations

- Continue to apply the present MFL criteria while completing ongoing efforts to further refine and calibrate the models and collect additional monitoring data.
- Results of these studies suggest that changes may be needed to storage facilities in the watershed and/or regional water delivery protocols to provide more freshwater to protect the *V. americana* community from significant harm.

- However, before any decisions are made to modify CERP projects or the MFL criteria, the models need to be completed and fully calibrated and improved flow measurements need to be obtained, especially for downstream tidal basin inflows.
- CERP, the Southwest Florida Feasibility Study, and RECOVER need to consider the implications of these MFL studies which, when complete, may suggest that different management approaches and/or performance measures are needed to protect the resource from significant harm.
- Once restoration needs for this system have been defined as a result of the Southwest Florida Feasibility Study, and reservations have been defined restoration needs, the existing MFL criteria will need to be modified to protect the restored resources from significant harm.